OLA FLOOD PLAIN MANAGEMENT STUDY

YELL COUNTY
ARKANSAS

COOPERATING AGENCIES

THE YELL COUNTY CONSERVATION DISTRICT

CITY OF OLA

The Arkansas Soil and Water Conservation Commission

and

U. S. Department of Agriculture
Soil Conservation Service
Room 2405
700 West Capitol
Little Rock, Arkansas 72201

JUNE 1984

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INTRODUCTION

The City of Ola, Arkansas, and the Yell County Conservation District requested that the Arkansas Soil and Water Conservation Commission conduct a flood plain management study for the City of Ola. The Commission requested assistance from the Soil Conservation Service to conduct this study.

The objectives of the study are to

1. Identify the flood hazard areas along Keeland Creek.
2. Quantify the flood hazard areas.
3. Investigate flood plain management alternatives.
4. Inventory natural values.

The Ola Flood Plain Management Study Report was prepared in accordance with the August 1974 Joint Agreement for Flood Hazard Analysis and Flood Plain Studies between the United States Department of Agriculture, Soil Conservation Service (SCS) and the Arkansas Soil and Water Conservation Commission (ASWCC). The ASWCC requested that the SCS conduct the flood plain management study. Participation by SCS is in accordance with Federal Level Recommendation 3 of "A Unified National Program for Flood Plain Management," Section 6 of Public Law 83-566, and principles contained in Executive Order 11988, Flood Plain Management.

The Federal Emergency Management Agency (FEMA) supplied flood hazard information in the form of a flood hazard map issued in July, 1982. Residents of the area provided survey access and participated in a meeting held on April 3, 1984, when study findings were presented and comments and responses were received from the public.

Field surveys were performed by SCS personnel to obtain required topographic information for the study. Water surface profiles were computed using the SCS WSP2 computer program. Peak discharges were determined by SCS Technical Release 20, "Computer Program for Project Formulation - Hydrology". Water surface elevations in the study area were obtained through the use of the above procedures. The Urban Floodwater Damage Economic Evaluation (URB1) computer program was used in calculating economic damages for present flooding conditions. Effects of a dam breach were determined by procedures found in SCS Technical Release 66, "Simplified Dam-Breach Routing Procedure."

Many variables are utilized in performing hydrologic studies. These variables include factors such as soil moisture condition, watershed land use, precipitation amount and time distribution, and channel characteristics that influence water flow. This study is based upon conditions existing at the time of field investigations and assumes that hydraulic structures do not fail.

STUDY AREA DESCRIPTION

The City of Ola (population 1,151) is located in Yell County about 75 miles west of Little Rock and about 20 miles south of Russellville (see vicinity map). The study area extends from the eastern city limits of Ola along Keeland Creek to the dam forming Lake Ola-Dale, a distance of about 1.7 miles. Keeland Creek is crossed by Arkansas Highways 7 and 10 and the Chicago Rock Island and Pacific Railroad. Keeland Creek outlets into the Petit Jean River, a tributary to the Arkansas River.

The study area is located in the Arkansas Valley Physiographic Region and is characterized by hilly topography which is largely forested with interspersed grassland. Ola has a mean annual temperature of about 62 degrees Farenheit and mean annual precipitation of about 48 inches.

Lake Ola-Dale was constructed by the City in 1960 as a municipal water supply. The dam is about 400 feet in length with a height of 36 feet. The reservoir contains about 950 acre-feet of municipal storage with a surface area of 85 acres. No flood detention storage is included in the structure. The spillway is a concrete flat-crested rectangular chute with a weir length of 80 feet.

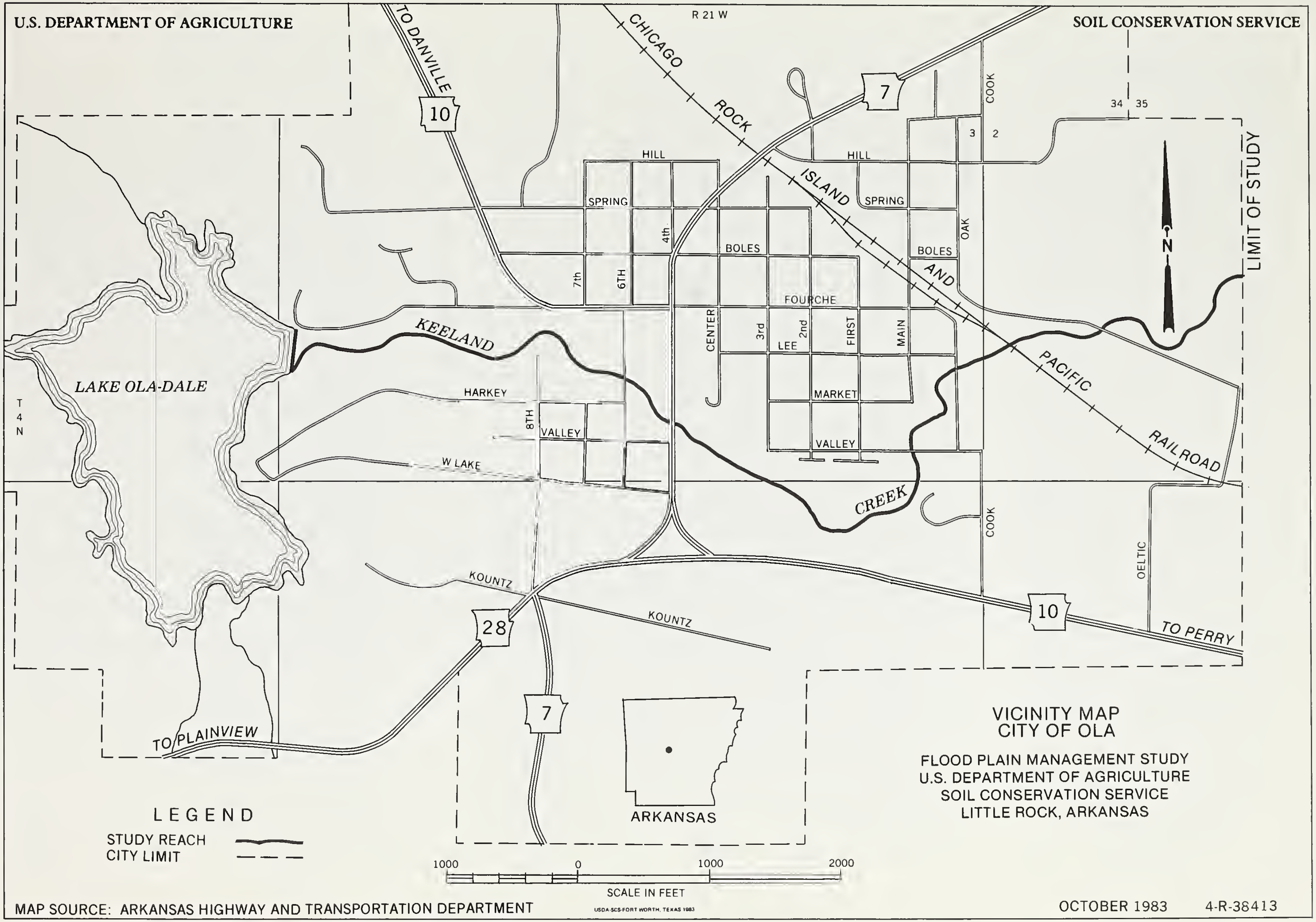
In a 1979 inspection report published by the Army Corps of Engineers, Lake Ola-Dale was classified as a high hazard structure because of downstream development. While the report states that the dam and spillway were in good condition, the project was considered as having a high hazard potential because the spillway is capable of passing less than 50 percent of the Probable Maximum Flood.

NATURAL VALUES

Soil Resources and Land Use.

The upland soils of the area are Carnasaw and Sherless soils. These deep, and moderately deep, loamy and clayey soils occur on rolling to steep hillsides. The land use is predominately woodland. Carnasaw, Cane, and Pickwick soils are found in the middle reaches of the study area. These deep, loamy and clayey soils occur on gently sloping to moderately sloping hills. Grassland and woodland are the main uses of this area. In the lower reaches of the study area and within Ola, major soils include Cane, Leadvale, and Pickwick soils. These deep, loamy soils occur on nearly level to gently sloping stream terraces. Grassland is the main land use of this area. Soils within the 1 percent chance floodplain include the Cane and Leadvale soils plus Spadra soils, a fine sandy loam.

Some prime farmland occurs in the lowest reaches of the study area. It comprises less than 1 percent of the total area. Land use in the 5,293 acre Keeland Creek watershed consists of 10 percent grassland, 7 percent urban, and 83 percent woodland; whereas, the study area's land use is classified as urban.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SOIL CONSERVATION SERVICE
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VICINITY MAP
CITY OF OLA
FLOOD PLAIN MANAGEMENT STUDY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS
MAP SOURCE: ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT
OCTOBER 1983 4-R-38413

Fish, Wildlife, and Water Quality. Ola can be characterized as a rural community with varied habitats distributed around the homes. Mature shrubs and hedges provide good habitat for song birds and small animals. Keeland Creek which meanders through this small community has an associated gallery of large trees including oak, pecan, hackberry, sycamore, and various species of shrubs. This intermittent stream has potholes in late summer due to seepage from Lake Ola-Dale. The fishery is limited, however, due to inadequate flows during the warm summer months. The small potholes do provide a source of water for birds and small animals that live in this urban habitat. Water quality is influenced by lack of flow during the summer months as well as by urban and industrial runoff. For these reasons water quality is poor.

FLOOD PROBLEMS

The flooding situation is not severe during small storms because some flood detention storage is realized in Lake Ola-Dale when municipal use lowers the water level in the reservoir. Flooding was experienced in Ola in December 1982 when heavy rainfall occurred throughout the state. The rainfall gage at Nimrod Dam, about 9 miles south of Ola, received 10.4 inches of rain in 24 hours during this storm (about a 1 percent chance event). During this flood, water flowed through the concrete chute spillway at the Lake Ola-Dale dam and also flowed through a low area located to the south of the dam. Damage occurred to the concrete spillway foundation, one bridge, and about 8 buildings. Water bypassing the concrete spillway does not flow in a defined channel but spreads out in a depression before flowing back into Keeland Creek about 800 feet downstream from the dam. The area inundated by the 1- and 10-percent chance floods is outlined on the Flood Hazard Area Map. The 0.2 percent chance flood was not considered because there are no schools, hospitals, or toxic chemical storage facilities in the flood plain.

According to study results, a 1 percent chance flood event would inundate about 96 acres in the study area and cause damage to eight buildings. Average annual flood damages are about $1,320. Extensive flooding and property damage and loss of life could occur should the dam impounding Lake Ola-Dale fail.

EXISTING FLOOD PLAIN MANAGEMENT

The City of Ola is an incorporated town governed by a mayor and city council. An ordinance concerning flood plain management was enacted when the City entered the Emergency Flood Insurance Program in 1977, and residents became eligible to purchase Federally-subsidized flood insurance. In July 1982, when Ola entered the regular phase of the flood insurance program a Flood Insurance Rate Map (FIRM) was published by the Federal Emergency Management Agency (FEMA) but no detailed hydraulic study was published. The FIRM delineates the area flooded by the 1 percent chance flood. FEMA will review the Ola Flood Plain Management Study (FPMS) for possible revision of its Flood Insurance Study.

ALTERNATIVES FOR FLOOD PLAIN MANAGEMENT

Present Conditions

Little development has occurred recently in the 1 percent chance flood plain. Recent development in the urban area has occurred to the south of Keeland Creek between Highway 10 and Lake Ola-Dale. Most of this area is higher than the 1 percent chance flood elevation, but within the area estimated to be flooded should a breach of the dam occur.

Nonstructural Measures

Nonstructural measures identified to address flood problems in Ola include acquisition of properties, floodproofing, zoning, building and development codes, flood insurance, and evacuation. The measures are intended to avoid or minimize flood losses but they do not modify the flood characteristics.

1. Acquisition consists of purchasing flood prone structures, removing them from the flood plain, and restricting land use in the flood plain. It would not be economically feasible to remove all the structures subject to flooding should a dam breach occur.

2. Floodproofing is modification of buildings, sites, or contents to keep water out or to reduce damage caused by the entry of water. Examples of floodproofing include sealing outer walls and installing waterproof closures at low openings, such as doors and windows.

3. Zoning is a means of controlling development within the designated flood plain. Continued enforcement of the existing city ordinance (Flood Hazard Prevention Ordinance No. 156, dated November 8, 1977) is necessary to insure compliance. This alternative would not have any impact on current flood damages but would prevent additional construction in the flood prone area.

4. Building and Development Codes recognize that development must be controlled in the flood prone area. In addition, if local officials decide that some development in the flood plain is feasible, building codes will dictate the type of construction which could be accomplished. This alternative would allow controlled development in the flood prone area and prevent flood damages to structures built in the future. These items are addressed in the Flood Hazard Prevention Ordinance. However, this alternative would not have any impacts on current flood damages.

5. Flood Insurance is available in Ola under the regular program. While flood insurance will not prevent flood losses, it may partially reimburse property owners for flood damages. Although Ola is in the flood insurance program, no detailed flood data was developed. Hydraulic data developed during this study should be sufficient for establishing actuarially-based flood insurance rates. A copy of this report should be submitted to FEMA for inclusion of elevation data on the Flood Insurance Rate Map and to establish actuarial rates.

6. Evacuation Plan - The possibility exists that an excessive amount of rainfall or a structural failure could result in the collapse of the dam which was declared hazardous because of inadequate spillway capacity. Should collapse be imminent, it would be necessary that residents below the dam be evacuated in a short period of time. A plan should be developed to monitor the potential for excessive runoff which might cause overtopping of the dam, to regularly inspect the condition of the dam and spillway, to promptly repair any deficiencies revealed during the inspection, and to evacuate residents of the area in the event that failure is likely. The area estimated to be inundated following a dam breach is indicated on the Flood Hazard Area Map.

Structural Measures

Structural measures are features to modify or control the flood to reduce losses. Structural measures include dams, channels, dikes or other appropriate items.

Modification of the dam on Lake Ola-Dale to include floodwater detention would reduce flooding in the flood plain. However, the extensive work required is estimated to cost in excess of $1,000,000. Based on the amount of current damages expected from flooding by the 1 percent chance and smaller volume floods, it would not be economically feasible to modify the dam or to construct a new dam near the present location. The economic analysis ignores damages that will occur due to dam failure and has no bearing on ways to reduce the probability of failure.

Channel work to excavate or realign the stream does not appear economically justified. Because of the slope in the stream, velocities are in the range of 4-6 feet per second. It would not be economically feasible to build a channel that would be stable with such velocities. Some work could be done to clear debris and vegetation retarding flow in the stream, although this would have little effect on larger storms. More frequent floods would be reduced significantly by clearing and debris removal. This would be a repetitive process to maintain channel capacity rather than a one-time alternative.

Combination of Alternatives

Structural measures are not warranted because of the high construction costs expected and the limited economic benefits to be derived from their use. Nonstructural alternatives are the best approach for offsetting existing flood damages and preventing additional damages.

The best combination of alternatives to compensate landowners for flood losses and/or to reduce damages may consist of the following measures:

1. Remove debris and vegetation which restrict stream flow.

2. Increase participation in the flood insurance program by eligible residents.

3. Enforcement of the existing Flood Hazard Prevention Ordinance to control further development in the flood plain.

4. Preparation of an evacuation plan to prepare for possible failure of the Lake Ola-Dale Dam. This alternative should include detailed planning on procedures to be used for evacuation, including widespread publicity among area residents to familiarize them with possible consequences should failure occur and how such an emergency situation will be administered.

FEBRUARY 1984 4-R-38517

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OLA FLOOD PLAIN MANAGEMENT STUDY
YELL COUNTY, ARKANSAS

FLOOD HAZARD AREA

KEELAND CREEK

GLOSSARY

Flood Damages: The destruction or injury of property due to rising water levels. In this study, flood damages were assumed to occur when the flood water elevation equaled or exceeded the lowest opening point into the damageable property.

Flood Frequency: An expression or measure of how often a hydrologic event of given size or magnitude should, on an average, be equaled or exceeded. For example, a 10-year frequency flood is equaled or exceeded in size, only once in 10 years on the average or has a 10 percent chance of occurring during any given year.

Flood Plain: A land area next to a stream which is periodically covered by floodwater.

Flood Proofing: Changing a structure and/or its contents so that water is kept out of the structure or the damage caused by water entry is reduced.

Flow Restrictions: An obstacle which limits the volume of water which passes through a specific section. Examples include dikes, dense vegetation, levees, culverts, bridge openings, buildings, and/or similar structures.

Field Surveys: The gathering of data with engineering equipment using horizontal and vertical distances to depict the features of stream valleys.

NGVD: National Geodetic Vertical Datum of 1929.

Peak Discharge or Peak Flow: The maximum volume of water per unit time that is expected as runoff from an area.

Percent Chance: 100 divided by the flood frequency in years.

Prime Farmland: The soil that is best suited for producing food, feed, forage, fiber, and oilseed crops. It gives the highest yields with minimum inputs of energy and money and results in the least damage to the environment.

BIBLIOGRAPHY

1. Technical Release 61, WSP2 Computer Program, Engineering Division, USDA, SCS, May 1976.

2. Technical Release 20, Computer Program for Project Formulation - Hydrology, Engineering Division, USDA, SCS, May 1982.

3. Urban Floodwater Damage Economic Evaluation, Computer Application Program, Economics Division, USDA, SCS, January 1982.

4. Soil Survey of Yell County, Arkansas, USDA, Soil Conservation Service in cooperation with the Arkansas Agricultural Experiment Station, (not published).

5. Inspection - Lake Ola-Dale Dam, Yell County, Arkansas, Summerlin Associates, Inc. for Little Rock District, Corps of Engineers, September, 1979.

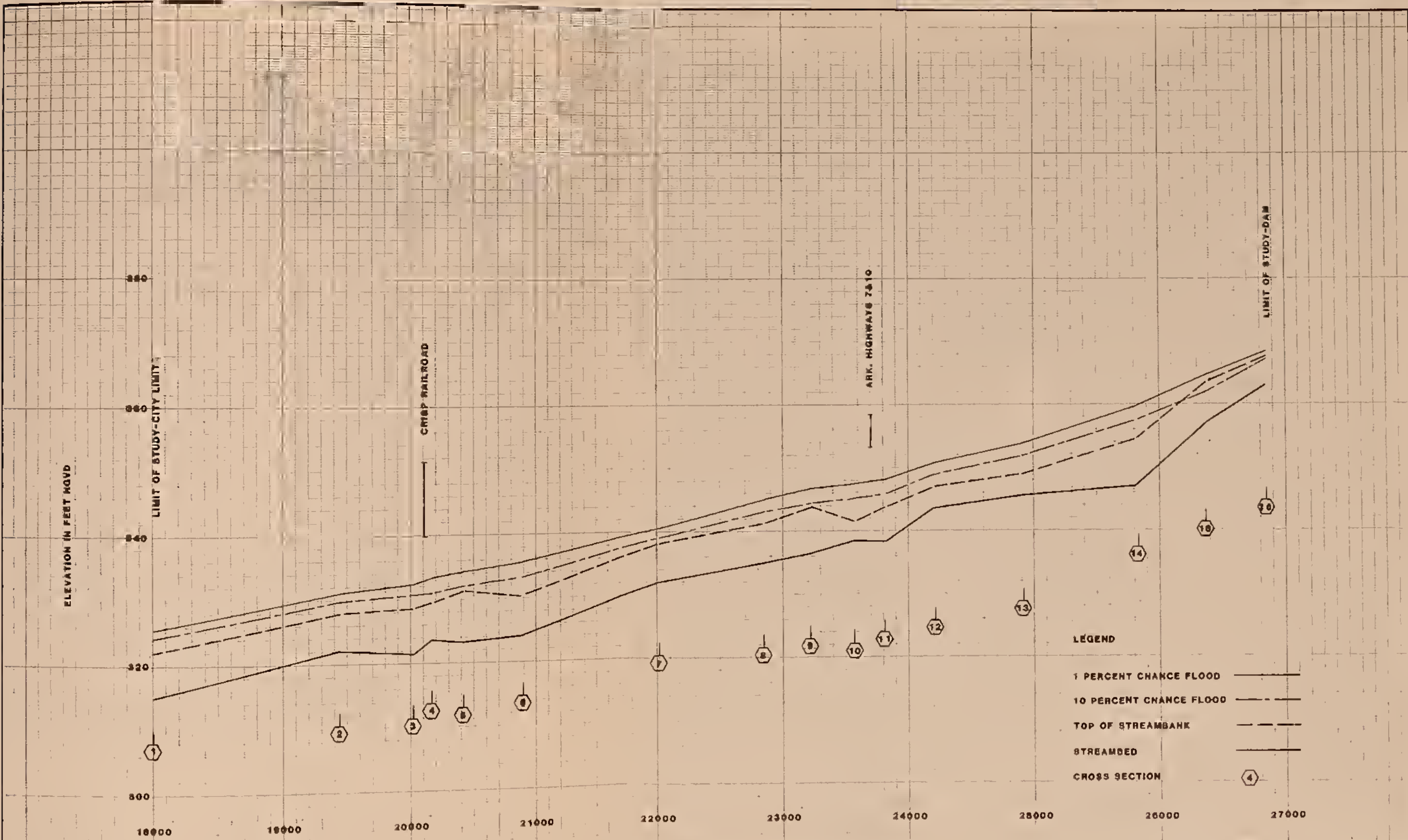
6. Technical Release 66, Simplified Dam-Breach Routing Procedure, Engineering Division, USDA, SCS, December 1981.

BENCHMARK DATA

USGS BM E-47 - 125 feet west of Highway 7 overpass and 50 feet south of Rock Island Railroad. Elevation 362.92 NGVD.

TBM - Top of fire hydrant northeast corner at intersection of W. Spring and N. 6th Streets. Elevation 386.22 NGVD.

T E C H N I C A L   A P P E N D I X



OLA FLOOD PLAIN MANAGEMENT STUDY
KEELAND CREEK
FLOOD PROFILES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawing No. APPENDIX 1

APPENDIX 2

CROSS SECTION DATA
OLA FLOOD PLAIN MANAGEMENT STUDY

Cross Section (No.)	Drainage Area (Sq. Mi.)	10 Percent Chance Event Discharge (cfs)	10 Percent Chance Event Elevation (feet)	1 Percent Chance Event Discharge (cfs)	1 Percent Chance Event Elevation (feet)	Breach Event Discharge (cfs)	Breach Event Elevation (feet)
1	8.27	2226	324.3	4705	325.4	29000	329.9
2	8.04	2200	329.9	4675	331.0	30200	335.4
3	7.96	2196	330.8	4653	332.3	30900	337.2
4	7.96	2196	331.0	4653	333.3	31000	347.0
5	7.93	2175	332.0	4600	334.2	31600	348.2
6	7.89	2175	333.3	4600	335.6	32800	348.8
7	7.53	2200	339.1	4575	340.5	35900	350.0
8	7.46	2200	343.2	4575	345.1	37800	353.9
9	7.36	2205	344.5	4561	346.8	38400	355.7
10	7.33	2205	345.3	4561	347.5	39200	356.0
11	7.33	2205	345.9	4561	348.1	39900	359.8
12	7.28	2250	349.0	4560	350.8	41400	360.5
13	7.23	2260	351.9	4555	353.7	43800	362.6
14	7.14	2270	357.5	4555	359.6	46600	368.4
15	7.08	2300	361.9	4555	364.6	47900	374.1
25	0.01	369 1/	378.9	1454 1/	379.7	18600 1/	384.0

1/ Includes discharge from reservoir through overflow area.

APPENDIX 3
Investigation and Analyses

Topographic information used in this report was gathered by SCS personnel. Additional topographic information was obtained from U.S. Geological Survey Quadrangle maps. Aerial photographs were obtained from the Agricultural Stabilization and Conservation Service Aerial Photography Field Office in Salt Lake City, Utah.

A staff biologist and a resource conservationist evaluated the study area to determine land use, soils, and fish and wildlife resources. Aerial photographs and soil surveys were utilized in the determination. The findings have been incorporated into this report.

Water surface profiles were computed using survey data and various other parameters as input into the SCS WSP2 computer program. Output from this program included elevation-discharge curves at specific cross sections. Peak discharge was computed for the 1 and 10 percent chance flood events by using SCS Technical Release 20 "Computer Program for Project Formulation - Hydrology". By combining the computed peak discharges and the elevation-discharge curves, the elevations for the floods were obtained at each cross section. The SCS 24-hour Type 2 rainfall distribution was used. Field surveys were made to determine the elevation of each building. Depth of flooding and flood damage was determined with the aid of the URB1 computer program.

The width of the flooded area was determined at each of the cross sections. This was done by using the elevation of the flood profile at that location and determining the point at which that elevation intersected the ground on the plotted cross section. The flood boundary between cross sections was delineated by interpolation between sections and through the use of quadrangle maps, additional surveys, and stereoscoping of aerial photographs.

A dam breach analysis was made by using procedures discussed in SCS Technical Release 66 "Simplified Dam-Breach Routing Procedure." Results of this procedure included the elevation of the breach outflow hydrograph at each cross section. The flood boundary between sections was obtained from stereoscoping of aerial photographs. The breach analysis included the following assumptions:

1. Failure would occur during the 100-year 6-hour storm.

2. Peak discharge rate at the dam (49,000 cfs) was based on the maximum height of the dam (36 feet above the streambed) and the formula $Q = 65(36)^{1.85}$.

3. The Att-Kin model was used to route the dam breach hydrograph downstream.

4. Inflow from downstream areas was ignored.

Information on the Lake Ola-Dale dam and spillway was obtained from a Corps of Engineer dam inspection report dated September, 1979. This information was used in conjunction with inflow hydrographs to determine outflow from the structure for the various floods considered.

A public meeting was held on April 3, 1984, at the Ola Community Center. About 40 persons were in attendance. The results of the study were presented and the findings were accepted by the sponsors. Questions and comments were made concerning blockage of the channel by debris and beaver dams and the availability of funds (other than SCS) for work to be done by the City.